

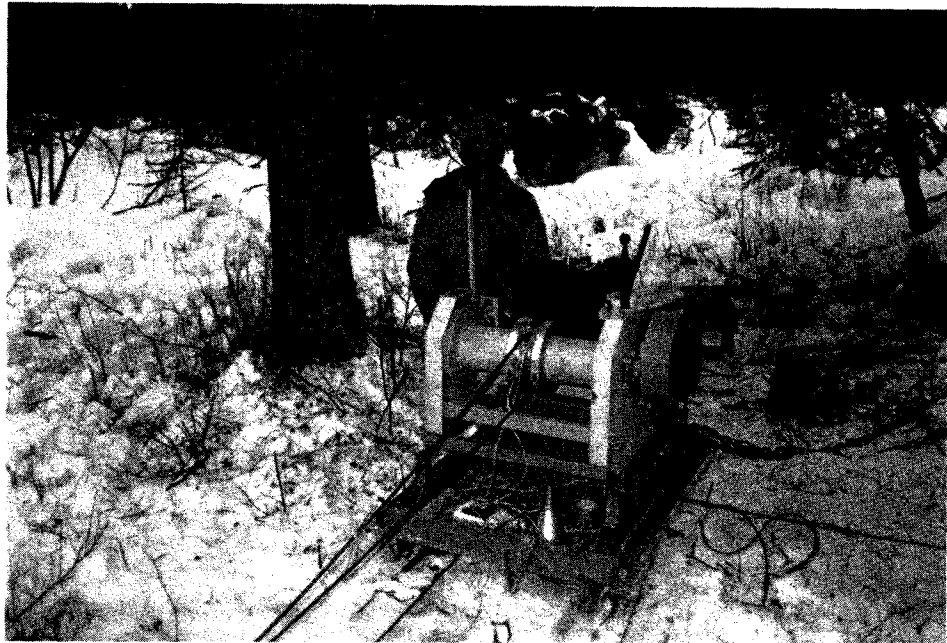


**United States
Department of
Agriculture**

Forest Service
Alaska Region 10
State and Private Forestry

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ZIG-ZAG MONOCABLE YARDER
A concept for yarding small logs
and
firewood



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NOTE

The mention of trade names or the sources of components does not constitute endorsement of these products by U. S. Department of Agriculture. The various pieces of equipment can be purchased through other sources or constructed by a machine shop except for the Zig-Zag blocks which have a patented design and presently are only manufactured by the mentioned Japanese company.

THE PURPOSE OF THIS BULLETIN IS TO PROMOTE THE ZIG-ZAG YARDING CONCEPT THROUGH THE USDA TECHNOLOGY TRANSFER INITIATIVE.

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THE ZIG-ZAG MONOCABLE YARDER

INTRODUCTION

The ZIG-ZAG monocable logging system was developed in Japan to harvest small, low-value trees and logging residue from sensitive, adverse sites and commercial thinning operations. The special design of the logging system allows the transportation of logs over small creeks, wet areas, through undisturbed forest, and up and down hills to a central gathering area. The size of the area to be harvested and yarded depends upon the length of cable being used and how the cable is laid out over the area. The yarder will normally handle logs up to 300 pounds and 18 feet long.

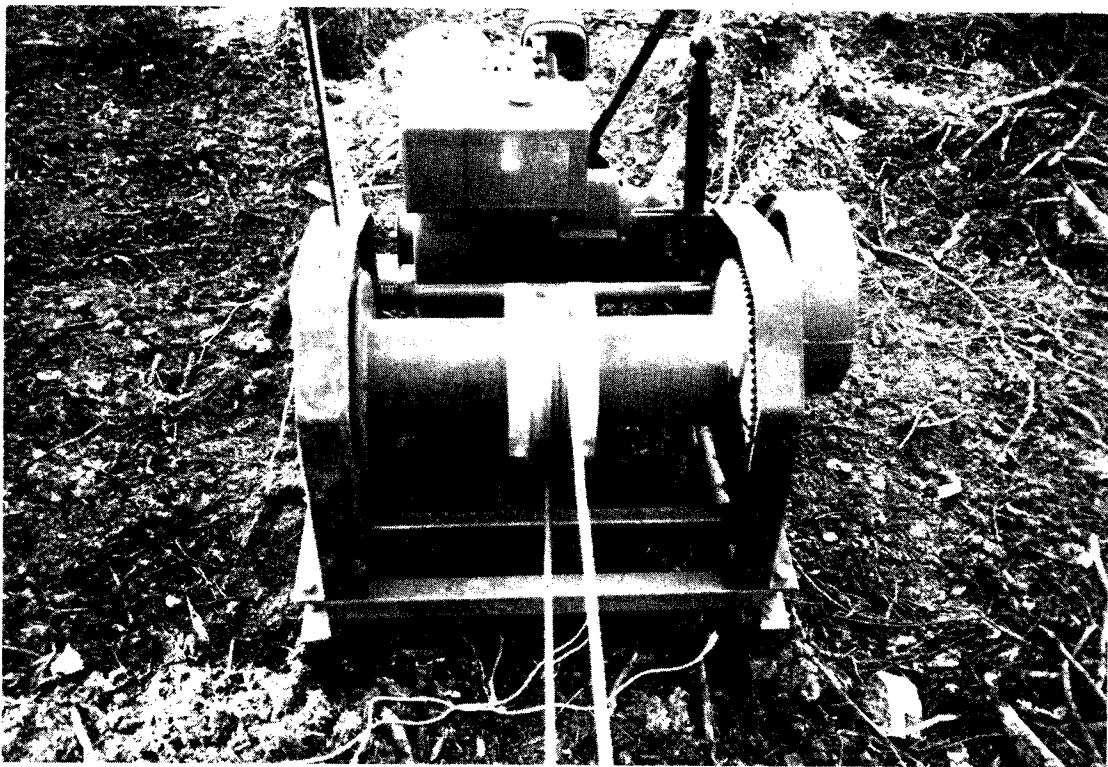


Figure 1 - The Zurfluh Capstan Winch (ZIG-ZAG Yarder) which is manufactured by Zurfluh Equipment Manufacturing Company in Switzerland.

GENERAL DESCRIPTION

The ZIG-ZAG system has a continuous loop of cable (1/4 to 9/16 inch diameter) called a "monocable". The cable runs through a series of specially designed open-sided blocks called zig-zag blocks (Fig. 2) which are suspended from support trees using tree-protective straps. The support trees must support both the cable and logs over such critical areas as slope breaks, fragile soil, and streams.

The monocable is driven by a capstan winch at a speed of 50-75 feet per minute. Logs are attached to the moving monocable by tying or hooking chokers to the cable, allowing the logs to travel continuously from the hooking locations to the landing. Various materials such as nylon cord, bailing twine, or similar materials can be used as chokers. When the logs reach the landing the choker is either cut with a knife or an automatic cutter can be used. The logs can either be dropped to the ground and piled by hand or dropped directly into the bed of a truck. The system is similar to an endless conveyer belt.

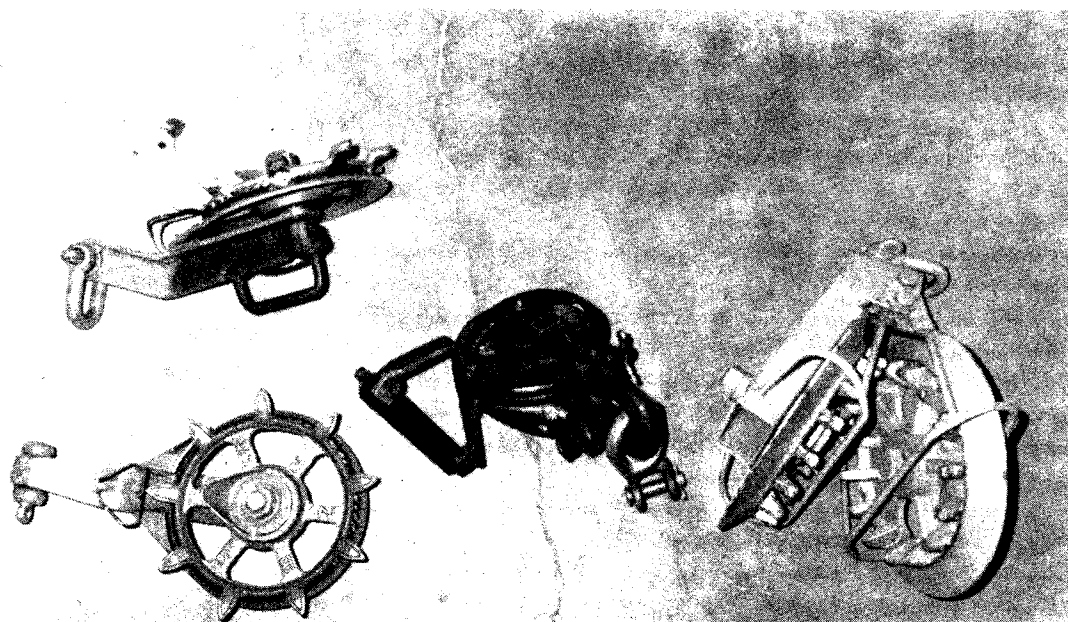


Figure 2 - Left - single zig-zag block, Model ZB-9; Center - cutter block; Right - zig-zag gear block, model ZB-12.

The length of the cable depends upon the size of the area to be logged. A monocable ZIG-ZAG yarder being used in Chile has over five miles of cable set up to harvest a particular area.

The winch required to operate the ZIG-ZAG system has three key elements: the engine, the capstan sleeve, and the gear box to control line speeds. The winch, as shown in figure 1, has a 10" capstan sleeve which is bolted in place at the center of a 6 inch steel drum. The sleeve is constructed out of an aluminum alloy and held in place by two allen bolts countersunk into the sleeve rim. A position pin in the center of the sleeve aligns the sleeve on the drum and holds it in position while the allen bolts apply the pressure. The drum is connected to the power source by a gear box which reduces the monocable line speed to 50-75 feet per minute. A double v-belt pulley is used to drive the drum. The power source is a Briggs and Stratton 10-horse air cooled, four cycle gas engine with a governor to regulate the speed.

LAYOUT DESCRIPTION AND SYSTEM OPERATIONS

After selecting an area to harvest, the support trees (leave trees) for the zig-zag blocks must be located and marked before any trees are felled. Keep in mind that the support trees must be sturdy enough to support both the cable and logs. Lay out the support trees in a zig-zag pattern (Fig. 3). The distance between the trees shouldn't exceed 100 feet. The inside angle between the blocks when yarding logs up to 9 feet long can range between 90° - 140° . For longer logs (10-18 feet) the inside angle should be between 100° - 120° . The main object of the angle is to have the zig-zag block retain a near as possible horizontal position when in full operation.

When selecting the support trees, the operator should look for areas with a minimal amount of debris, brush, down logs, etc. and with trees located in a pattern that will minimize hand carrying of the logs. The inside corners of the zig-zag pattern should not have objects (standing trees, etc.) that are within a distance from the zig-zag block that is equal to or less than the longest log to be yarded plus 5 feet. An exceptionally close leave tree to a zig-zag block will cause the longer logs to hang up as they move around the corner.

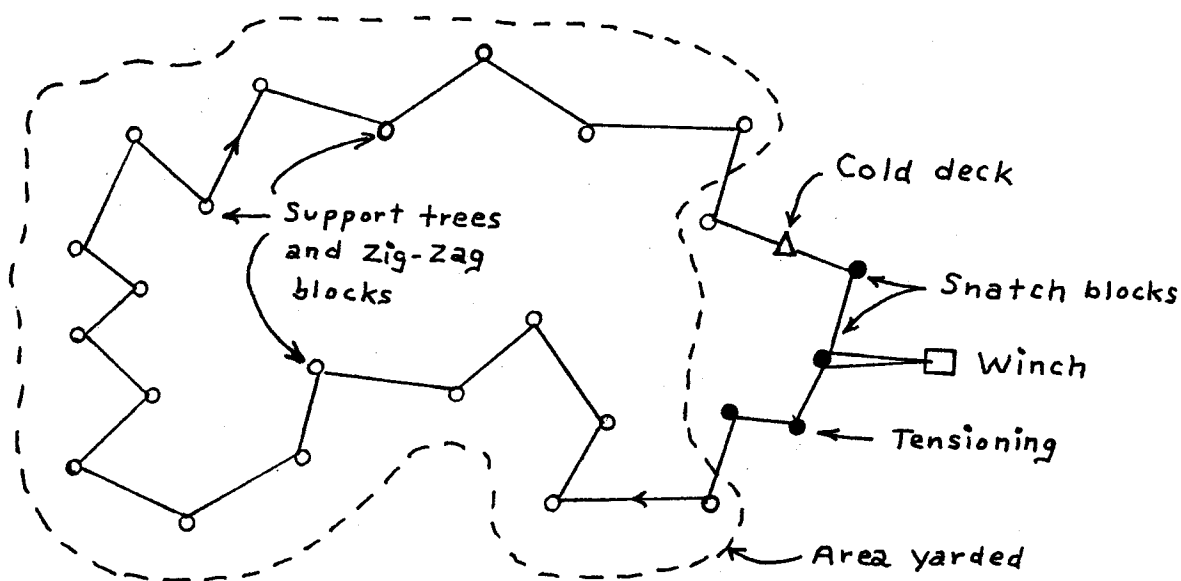


Figure 3 - A typical profile layout of the zig-zag yarding operation.

The trees designated for harvesting should be felled away from the cable location. This will prevent a massive debris removal problem when preparing the skidding corridor area for yarding the logs. Prior to yarding the logs all the limbs must be removed and the bole clean of any stubs. The maximum log length will depend on the weight. A two-person crew must be able to lift the end of the log in order to attach it to the cable. The system is designed to handle logs weighing up to approximately 300 pounds.



Figure 4 - Yarding firewood size birch logs. Note the tree protective strap which is used to support the zig-zag block, model ZB-9 and how the block is in a near horizontal position and 7-9 feet off the ground.

Tree-protective straps are wrapped around the selected zig-zag support trees at a height of 7-9 feet or as high as possible while still allowing the cable between the blocks to be in reach of the crew members (Fig. 4). The yarding operation performs best when the cable is high enough to keep all logs completely off the ground after they have been tied to the cable. At no time should the leading end of the log (closest to the cable) be allowed to drag on the ground. If this occurs during operation, the support straps need to be lifted higher. After the tree-protective strap is secured to the tree, attach the zig-zag block, model ZB-9, to it. The zig-zag block should be approximately 3-4 feet from the tree when the strap is fully extended outward.

The zig-zag gear block, model ZB-12 (Fig. 2) should be used when the distance between the zig-zag support trees is greater than 100 feet, or when the angle is greater than 140° . The block can be hung between two trees using tree protective straps and connecting the block to the protective straps with a $1/4 - 9/16$ inch diameter cable or a $1/2$ inch nylon rope. If no trees are available, a log tripod could be erected and the zig-zag gear block hung from the center of it. When using this method, the height of the tripod must be based upon the longest length of log that will be yarded using a choker on one end. Keep in mind the length of the choker line in addition to the log length when establishing the height of the tripod.

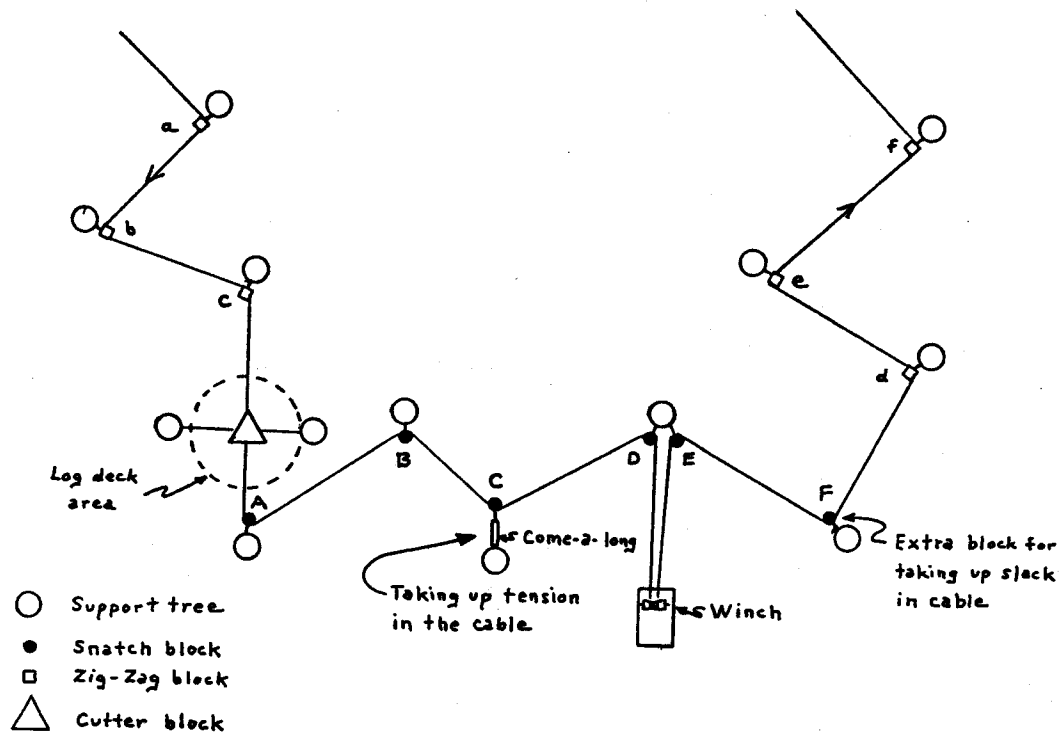


Figure 5 - A typical layout of the zig-zag yarder base area.

The winch must be located approximately 20-30 feet in front of a large tree. On the tree, wrap two tree protective straps around it approximately the same height as the winch and attach a regular snatch block (snatch blocks 'D' and 'E', Fig. 5) with swivels to each one. The blocks are used to guide the incoming and outgoing cable from the winch (Fig. 6).

The selection of the log deck location must be between two tall large trees, approximately 20-25 feet apart. Suspend the special designed cutter block (a snatch block with a cutter attached - Fig. 2, 5, and appendix) between the two trees using tree protective straps connected with a 1/4 - 9/16 inch diameter cable or a cable - 1/2 inch nylon rope combination. The cutter block is attached to the cable portion with a swivel/shackle so the block can free float and seek its own location. The height of the block above the ground may vary depending upon whether logs will be decked on the ground or loaded directly into a truck (Fig. 7). It should be noted when the system is operating the logs pile up fast and must be cleaned out under the cutter block quite often. The other alternative to this is to move the cutter block system forward and create a new ground deck provided there are support trees available to use without having to relocate the cable layout.



Figure 6 - The winch (center) with the incoming and outgoing yarding cable running to two regular snatch blocks. The snatch blocks are suspended by a tree-protective strap.



Figure 7 - The specially designed cutter block. Note how it is suspended in the air by a combination of a tree-protective strap and a 3/8 inch cable.

Now locate a tree or stump approximately 30-40 feet beyond the cutter block and in a direct line between the last zig-zag block (zig-zag block 'c', Fig. 5) and the cutter block. Using a protective strap around the tree or stump, attach a regular snatch block (snatch block 'A', Fig. 5) with swivel to it. The snatch block must be lower in height than the cutter block.

A come-a-long jack (Fig. 5) needs to be installed for adjusting the monocable tension between snatch block 'A' and the last snatch block 'D' of the system or between the first snatch block 'E' and the first zig-zag block 'd'. On the cable end of the come-a-long attach a regular snatch block 'C' with a swivel. The snatch block 'C' is then attached to the monocable. A tensiometer may be installed between the come-a-long and the support tree to monitor the cable tension. Two things to remember: 1) the distance between where the come-a-long is anchored to and the location of the monocable must be slightly greater than the length of the come-a-long's cable fully extended; and 2) there shouldn't be any obstacles between the come-a-long and the monocable to obstruct the cable when the tension is applied.

If necessary, incorporate extra regular snatch blocks (snatch blocks 'B' or 'F', Fig. 5) with swivels into the cable lay out to create additional zig-zags in order to reduce excessive slack in the cable. Be careful to avoid any sharp angles in the cable layout when using any of the snatch blocks.

The winch can now be moved into its place and secured using a loggers chain attached to a solid anchor such as a large tree or stump (Fig. 6). There should be very little movement of the winch when the tension is placed on the cable.

Once all of the blocks are in place, the cable is ready to be strung out. To assist in this operation, place a length of pipe through the center of the cable reel and place it on some type of stand (example - two stumps 2-3 feet apart, notched on the top to support the pipe and cable reel). If more than one reel of cable is used, the cable will need to be spliced together. (When more than 1000 feet of cable is used, a 3/8" rope will have to be used as a leader to pull the cable around using the winch for pulling the line because of the cable weight and friction.) After the cable has been pulled through all the blocks, wrap it around the capstan drum (on the winch) three times with the incoming line on top of the drum. Now splice the two ends of the cable together to form a continuous loop using a long cable splice or a commercial sleeve splice ("Pulling Grips").

A 14-foot cable splice should be used if the cable length is over 1,000 feet. Under 1,000 feet, a commercial sleeve splice (Fig. 8) can be used instead. When using the sleeve splice, clean the cable of all dirt and grease for the length of the splice. Make sure the cable ends have a clean cut and wrap plastic electrical tape around them to keep the loose cable wires from fraying, or have each end cut with a cutting torch which will weld the loose wires together. Each end of the cable can now be pushed half way into the sleeve to complete the splice.

The angle of the incoming line from the last snatch block (snatch block 'D', Fig. 5) to the capstan drum is critical, especially when the commercial sleeve splice is used. It must be a straight lead-in while the outgoing line must be approximately at a 50°-100° angle. If the proper setting is not

made, the cable splice will slip under the cable wrap on the drum and bind up when the sleeve rotates around it. After applying the tension to the cable, an operational check must be made prior to attaching any logs on the monocable line to see if the proper angle has been obtained.

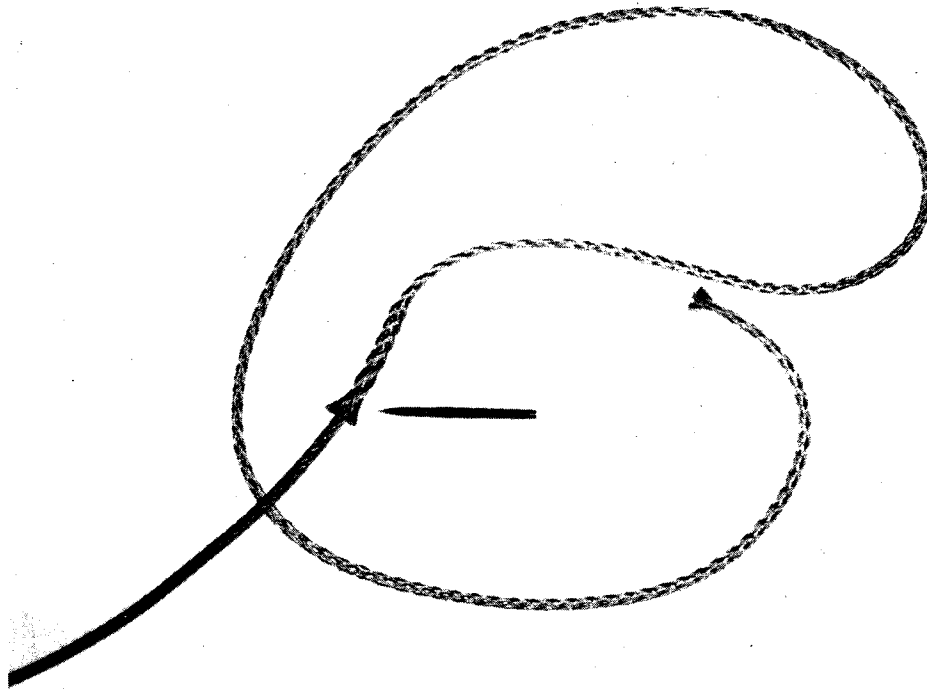


Figure 8 - The commercial sleeve splice. The pen is pointing to where one end of the 3/8" cable is being pushed into the sleeve splice. The cable is pushed in half way. The other end of the cable is then pushed in from the other end of the sleeve splice until the cable ends touch.

The tension can now be applied to the cable. Attach the snatch block (snatch block 'C', Fig. 5) on the end of the come-a-long's cable (which must be fully extended) to the monocable. The cable on the come-a-long can now be winched in to obtain the proper tension on the monocable which may vary between 500 to 1,000 pounds. When the cable sleeve splice is used the tension should be no greater than 500 pounds. After applying the tension, check the sleeve splice to see if the ends of the cable have pulled apart. If a gap of more than 1/2 inch develops, the splice must be done again. If there is a gap less than 1/2 inch, wrap both ends of the sleeve splice with heavy duty duct tape to smooth its passage through the blocks.

Inspect the entire layout before start-up to be sure the cable is still in place in all the blocks and not hung up anywhere. At the same time, clear an unobstructed pathway under the cable of any debris, brush, down trees, etc. to allow free flow of the logs being yarded. It only takes a small hang-up to break the choker cord holding a log to the cable.

The system is now ready for operation. Begin yarding by starting the winch engine.

OPERATION OF THE ZIG-ZAG YARDER:

Pre-cut the nylon cord or bailing choker twine into 6 foot lengths before going into the field. Though not necessary it will speed up the field operations.

A yarding crew consists of two individuals. One person brings the log over to the monocable and holds one end of the log up in the air while the other person, using a slip knot or a lariat loop, ties the choker (nylon bailing twine) to the end of the log. The choker should be tied 4"-8" from the end of the log. The other end of the twine is then attached to the monocable using a clove hitch knot (Fig. 9 & 10). After the knot is tied, the end of the log should hang 8"-14" from the cable. Remember, the cable is always in motion and the person tying the choker to the cable must keep this in mind at all times. The knot around the cable must be loose until the knot is completed then tighten the knot. Otherwise, the cable will pull the log prematurely creating a problem for the person holding the log. When using heavier or longer logs, two or three chokers should be used together to provide a stronger connection to the cable.



Figure 9 - Tying a log to the monocable. Note the location of the choker twine on the log. On the left, a zig-zag block is being used to hold down the monocable so it can be easily reached for tying the knot.

The ideal yarding crew would be three persons. Two doing the work described above while the third person gathers the logs and stacks them next to the cable.

If the monocable is too high to reach by hand without jumping, a "pulling-down block" system can be used to bring it within easy reach. Attach a regular snatch block to the monocable. Use a rope to pull the snatch block down to the desired cable height and tie it to a heavy log, tree, or stump. This pulling-down block system will provide a greater margin of safety for the choker setter (Fig. 9 & 10).

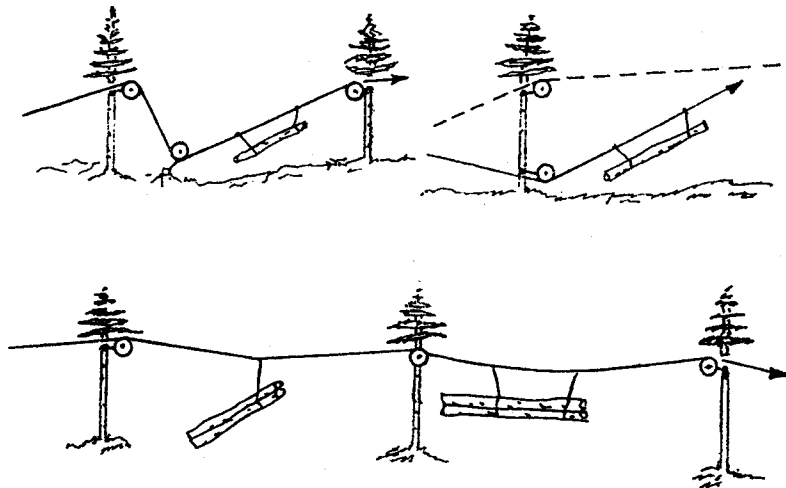


Figure 10 - Top sketch - two methods of "pulling down" the monocable using a regular snatch block to bring the cable within easy reach. Bottom sketch - two methods of attaching the log to the monocable.

Longer logs may be tied on both ends of the monocable (Fig. 10). When doing this, station a person at the cutter block to cut the rear choker before the front choker goes through the cutter block to prevent jamming the front end of the log into the pile.

Never attach more than 300 pounds of weight on the cable between two of the zig-zag blocks when using commercial sleeve splice. One log weighing 300 pounds, or two to three logs weighing a total of 300 pounds may be suspended from the cable between any two zig-zag blocks. (When using a long cable splice, the cable will support a heavier load though it is limited by the log weight two persons can pick up and tie to the monocable.) Try to space the logs equally. Avoid placing two or three logs close together followed by a large gap.

The falling or limbing crew has a tendency to miss a limb or two. Therefore, it's advisable that the yarding crew have a limbing axe or small chain saw available. They need to cut off any stub or limb that was left on the log to prevent hang-ups as it is being yarded.

The yarding system is designed to accommodate any number of 2 or 3-person crews. Crews should be spaced out over the entire system in order to operate most efficiently. When yarding is completed in any section, it is recommended that the zig-zag blocks be raised higher on the support trees in order to suspend the logs as they pass through the area. This will reduce the risk of hanging up a log, breaking a choker and causing a pile up.

A person should be stationed at the engine/winch during operations to watch for possible malfunctions and to provide for systems shut down in an emergency. If possible, this individual should have constant radio contact with the yarding crew. While at the engine/winch location the individual can be cutting the remains of the choker lines off the cable, checking the splice for wear, and performing general maintenance to the yarder and blocks.

When in high production mode, it would be wise to have a person working on the log deck to keep the logs from piling up under the cutter block.

The operation should run smoothly, but as with any mechanical system there are several things that can go wrong. To prevent a lengthy breakdown or additional work the following precautions are advised:

1. After starting up the operation and logs begin to come in, check each zig-zag block to see if it is retaining a near horizontal position as the yarded logs go past each block. If there is too much slack, insufficient angle between the support trees, or the zig-zag block is sagging considerably under the weight of the logs, the block needs to be relocated to a different support tree to obtain lesser angle or be replaced with a modified zig-zag block (Fig. 11). When the modified block is required, use a rope to support it in a horizontal position by tying the rope to the eye and a near by tree. If this doesn't work, then a zig-zag gear block must be used. If this isn't corrected, the guide wings on the zig-zag block will cut the choker line as the log tries to pass by it or it could cause the cable to jump out of the block.

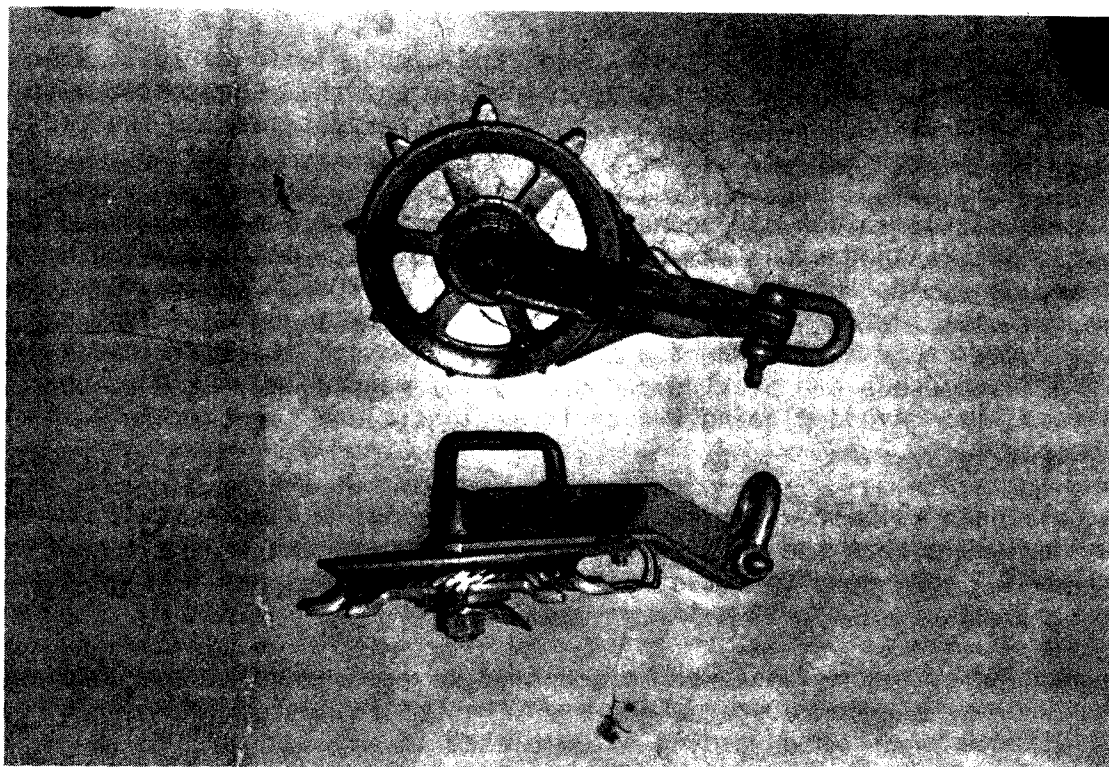


Figure 11 - The modified zig-zag block. The eye on top of the block arm was welded on by a local welder.

2. After every 2 - 3 hours of operations, check the entire line to see if any hang-ups are occurring.
3. If no one is assigned to the log deck, it should be checked at the same time to see if there is still ample room for the cutter block to work properly. If there is insufficient room, the logs need to be cleaned out from under it.
4. Inspect the splice every 3 hours of operation when using the commercial sleeve splice ("Pulling Grip"). If a gap of 2 inches or more develops between the two cable ends, the splice should be reset. Also check the duct tape for wear. If any of the brass ends of the commercial sleeve are exposed, re-wrap.
5. If no one is stationed at the yarder, then at the end of each day's operation (or more frequently if necessary) the nylon cord or baling twine hanging on the cable should be cut off to prevent a build-up and bunching of the used chokers which may jam in the blocks.

PRODUCTION

Figure 12 shows an actual operational layout of the Zig-Zag yarder using 3,000 feet of cable. The straight line distance between the winch and the most distant block on the cable in this particular layout was 1,100 feet. Starting from the winch, the cable traverses 650 feet through a nearly flat, old growth area with a stream crossing. No material was removed from this area. The cable then traversed downhill into the area designated for harvesting.

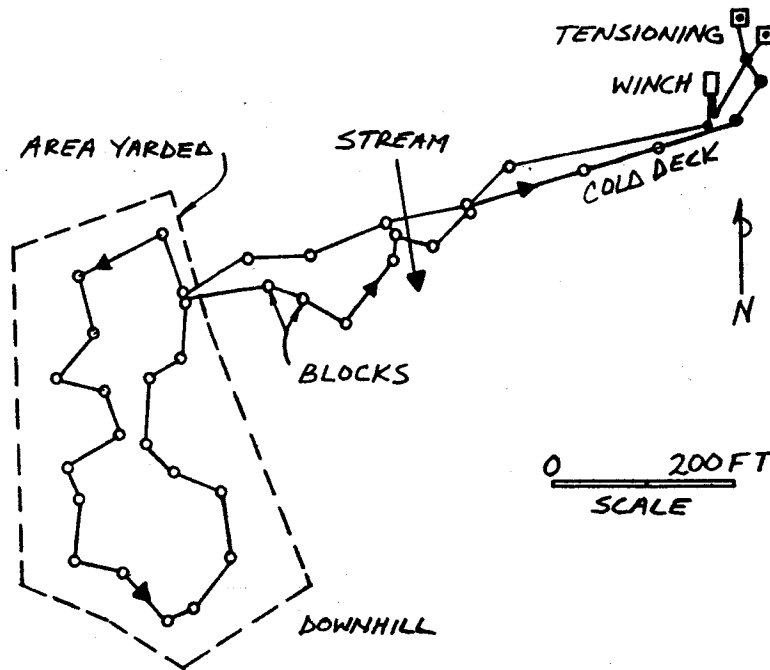


Figure 12 - A sketch showing an operational lay-out of the ZIG-ZAG yarder which was operated by the U.S. Forest Service in the State of Washington.

Data collected from the particular layout showed that two inexperienced persons processed 48 pieces, or 77 cubic feet, (about 1/2 cord) per hour. One person limbed, freed the logs from the nested machine piles, and moved the logs an average of 15 feet toward the monocable. Another person moved the logs an average of 10 feet and attached the logs to the monocable. The average size log was 6 inches DBH, 9 feet long and weighed 56 pounds. Two experienced persons, however, processed 120 pieces or 192 cubic feet (1.5 cords) per hour without delays - both persons attached the logs. Little handling was needed because the logs had been piled near the monocable.

SAFETY

The ZIG-ZAG yarder system is a mechanical device and like any other mechanical operation, safety is of prime importance to the crew members. Though the zig-zag yarder is a relatively safe system to work with, there are several safety items a user must be aware of. They are:

1. The yarding operation is a cable system and by the nature of the layout, anybody working with it will always be in the bite of the line. If the monocable did break or come apart at the commercial splice sleeve, the cable could injure a person if they were within the bite of the line when it breaks. To minimize the risk, never stress the system beyond its safe operating capacity of 500 pounds cable tension when using the commercial splice; 1,000 pounds cable tension with a long splice; and a maximum total log weight of 300 pounds between the zig-zag blocks.
2. Tying the choker line to the monocable is probably the most hazardous activity involving the yarding system. It is very easy to get a finger caught in the knot when tying the cord to the cable. The only way a person can prevent this from happening is always being aware of the situation and alert at all times. If it does happen, there is only a short time before the finger will become entangled with a zig-zag block resulting in a crushed finger. To reduce the risk, every person should be carrying a sharp hunting knife that is readily accessible to either hand in case of an emergency. (A pocket knife or folding knife in a case is not acceptable.) Once caught, immediately cut the choker line to get rid of the log. Then try to either untie the choker line from the cable or cut the line between the cable and the finger. Remember, the cable is traveling 50-70 feet per minute so it will require quick action.
3. Proper procedure in cutting the choker with a knife should be used. Always cut away from the person - never towards the person.
4. The yarding system requires lifting of moderate to heavy logs. Using improper lifting procedures could result in injuries to the body. The risk of injury can be reduced by having a second person help lift the heavier logs.
5. Wear leather gloves when handling the cable. Small broken metal wires in the cable can cause numerous cuts to bare hands.
6. Dropping a log on a toe or leg is another potential hazard. A person must be aware that an injury could result from this. Preventative action would be to wear high leather boots with steel toes.
7. In case of a breakdown and it requires removing the logs from the cable to make repairs, be sure no one is standing next to the cable when choker lines are cut. The cable will suddenly leap up with a sufficient force to knock a person down when the choker cable is cut.

There are other indirect safety hazards associated with the yarder. They are: using a chain saw to fall, limb, and buck up the trees, pruning the limbs from the support trees, transportation, and equipment loading and unloading. A person needs to follow the standard operation safety procedures associated with these activities.

LITERATURE CITED

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FOR MORE INFORMATION

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APPENDIX

- * ZIG-ZAG EQUIPMENT AND COST
- * SPECIAL SNATCH BLOCK/CUTTER DESIGN
- * ADDITIONAL PICTURES OF THE ZIG-ZAG YARDER OPERATION.

ZIG-ZAG EQUIPMENT AND COST

<u>Equipment</u>	<u>Cost (1987 price in U.S. \$)</u>
Zurfluh Capstan Winch w/10 HP gasoline motor Weight - 637 lbs (shipping wt.)	\$7000.00 (F.O.B. Anch., AK)
Source: Swissco Inc. ATTN: Robert Furrer 6520 Clara Street Bell Gardens, CA. 90201	
ZIG-ZAG Block model ZB-9 Recommend 1 block for every 75 feet of cable used.	\$ 90.00 (F.O.B. JAPAN)*
ZIG-ZAG Gear (double) block model ZB-12 Need a minimum of two double blocks.	\$ 110.00 (F.O.B. JAPAN)
Source for both zig-zag blocks: IWA FUJI Industrial Co. Ltd. No. 7-2, 1-Chame, Nishi-Shinjuku Shinjuku, Tokyo, JAPAN	
* Blocks were shipped air freight. Shipping cost for 52 blocks was \$2,525.00. The cost of shipping surface freight is unknown.	
Interpret Tension Load Cylinder (TM-5) (Tensiometer - one needed)	Unit price \$503.00
Source: Jackovich Industries & Constr. Supply 1716 Post Road Anchorage, AK. 99501	
Pulling Grips, model-0, 6' - both ends open, use with 3/8" cable (need a minimum of 4 of these commercial sleeve splices.)	Unit price \$ 42.80
Source: Louis Manufacturing Co. P.O. Box 95089 Oklahoma City, OK. 73143-5089 (405) 634-5401	
Aluminum Shipping Box, item #452110 Size 30"H x 18"D x 15 1/2"W Wt. 18# (need 1 to 4 boxes, depending upon the amount of blocks and straps obtained, to store the loose equipment in.)	Unit price \$203.00
Source: Myhres Exploration Products Remote Site Support, Services & Supplies 3404 N. Regal Spokane, WA. 99207 (509) 482-0332	

Source of the following items: Arctic Wire Rope and Supply
4973 Eagle St.
Anchorage, AK. 99503

<u>Equipment</u>	<u>Cost (1987 price in U.S. \$)</u>
3/8" extra-improved plow steel wire rope (Based on 1,000 ft. plus of rope)	unit price \$.54/foot
Skookum-half side block, A-6, 6 X 1 1/8 sheave (need minimum of 12 blocks)	unit price \$245.00
8" Marlin Spike (need for making a long cable splice)	unit price \$16.50
6" Marlin Spike (need for making a long cable splice)	unit price \$16.00
Tree-protective straps	
3" x 10 1 ply Nylon w/ Tri x Tri	unit price \$ 40.50
3" x 10 2 ply Nylon w/ Tri x Choker	unit price \$ 64.65
3" x 10 1 ply Nylon w/ eye x eye	unit price \$ 21.75
3" x 10 2 ply Nylon w/ eye x eye	unit price \$ 34.25
(need minimum of one tree-protective strap for each Zig-Zag block and regular block ordered - any combination of the above straps)	
3/16" x 1200' polypropylene rope (need the same length as the cable used. - Used for pulling the cable through the blocks when over 1,000' of cable is used.)	unit price \$ 17.10
404 WN Come-A-Long jack (need one)	unit price \$124.00
Twine, nylon, 10# box, approx. 3,000 ft (350# knot breaking strength) (choker twine - number of cartons depends upon the number of logs to be removed.)	unit price \$ 16.95 (carton)
Skookum 6" block #A-6R, 1/2" grove (need one for modification as a cutter block - see attached diagram)	unit price \$195.00
3/8" x 20' binder chains w/hooks (need 2 for tying down the yarder)	unit price \$ 27.00
Crimping tool, single hold, 3/8" (need one for making cable slings)	unit price \$175.00
Sleeves (need a minimum of 12 - used for making a loop in the cable sling)	Unit price \$.65

Shackles, SPA, 3" (need 20)	Unit price \$ 2.90
Swivel, EXT, 1/2" (need one for each regular snatch block)	Unit price \$ 9.50
Thimbles (eye) 3/8" (need minimum of 12 - for making the loop in the cable sling)	Unit price \$.69
SC-1 cable cutter 3/8" (need one)	Unit price \$ 45.00

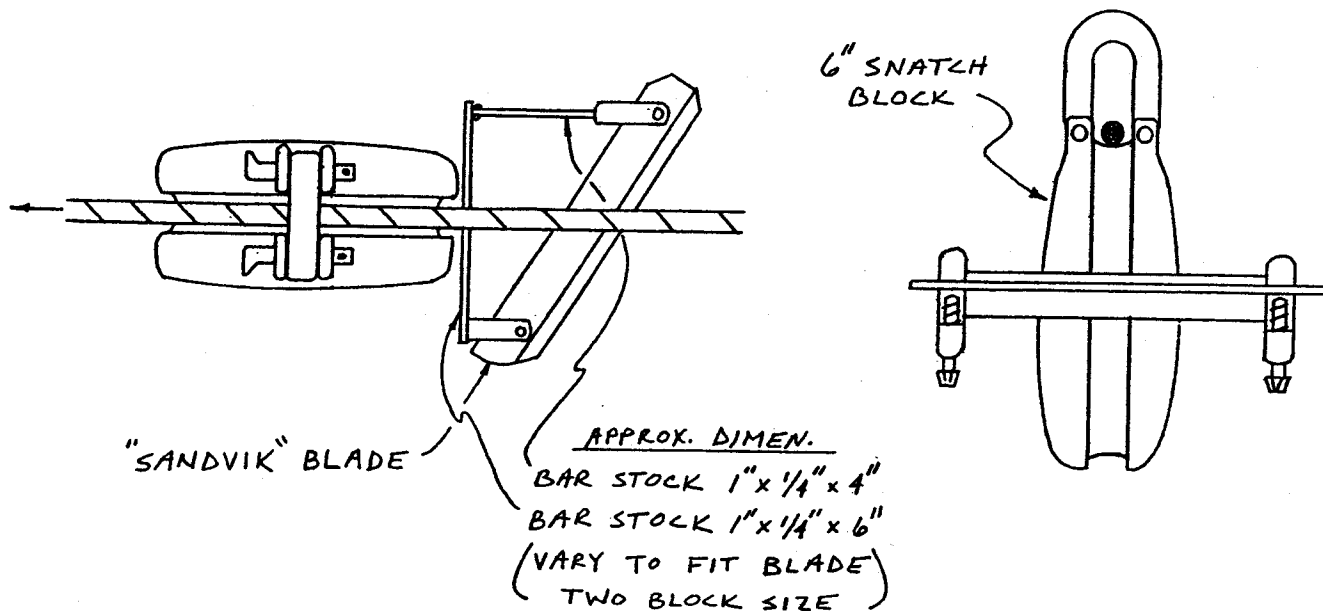
Other tools and supplies needed:

10/30 SE grade oil
 5 gallon safety gas can
 Funnel, 1/2 gal.
 Oil can, 1 quart (measure)
 Screw drivers (misc. sizes)
 Crescent wrenches (misc. sizes)
 Grease gun
 Grease (multi-purpose) cartridge
 Tool box (general, two handles)
 Hammer, double face 2 1/2#
 Wrench set, comb. 5/16" through 1"
 Mechanics socket wrench set, 3/8" through 7/8"
 Ladder, 14' extension, aluminum
 Whetstone to sharpen blade on cutter block
 Extra Sandvik blades (blade for the cutter block)
 Axe
 Limbing saw, hand
 Small chain saw
 Flagging, surveyors
 Tape, duct
 Tape, electrical
 A bar or 1 1/2" pipe to allow the cable spools to turn freely
 Pocket knife with sharp blade
 Extra grease fitting nipples for blocks

NOTE: THE FOREST SERVICE DOES NOT ENDORSE ANY PARTICULAR COMPANY AS A SOURCE OF PURCHASE. THE COMPANIES LISTED ARE SIMPLY THOSE WHERE THE FOREST SERVICE HAPPENED TO OBTAIN THE EQUIPMENT.

Cost and equipment required may differ from what is listed due to use of special system design of the USDA Forest Service to test a variety of yarding techniques.

SPECIAL SNATCH BLOCK/CUTTER DESIGN

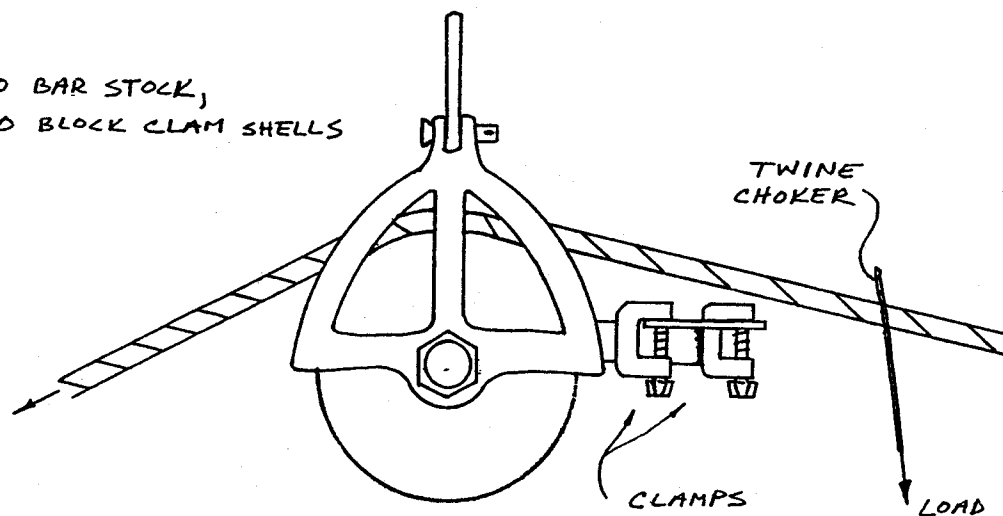


TOP VIEW

FRONT VIEW

NOTE:

WELD CLAMPS TO BAR STOCK,
 WELD BAR STOCK TO BLOCK CLAM SHELLS



SIDE VIEW



Tom Ward, SCS State Forester adjusting the cable tension to 500 pounds pressure using a come-a-long and tensiometer.



The zig-zag block. In order to perform properly, the block must be in the near horizontal position after the tension is taken up in the monocable line.



The yarding with the ZIG-ZAG yarder called for crossing a 300 foot wide stream bed. Therefore, two 18 foot log tripods were constructed with a zig-zag gear block hung in each one. This allowed the logs to be suspended in the air when they crossed the stream.



Taking up excessive slack in monocable line after the cable was spliced.



The zig-zag gear block. The block is being used in a sensitive area where trees cannot be removed to allow zig-zagging of the monocable through the area. Therefore the cable had to be laid out in a straight line greater than 100 feet which called for the use of the gear block.